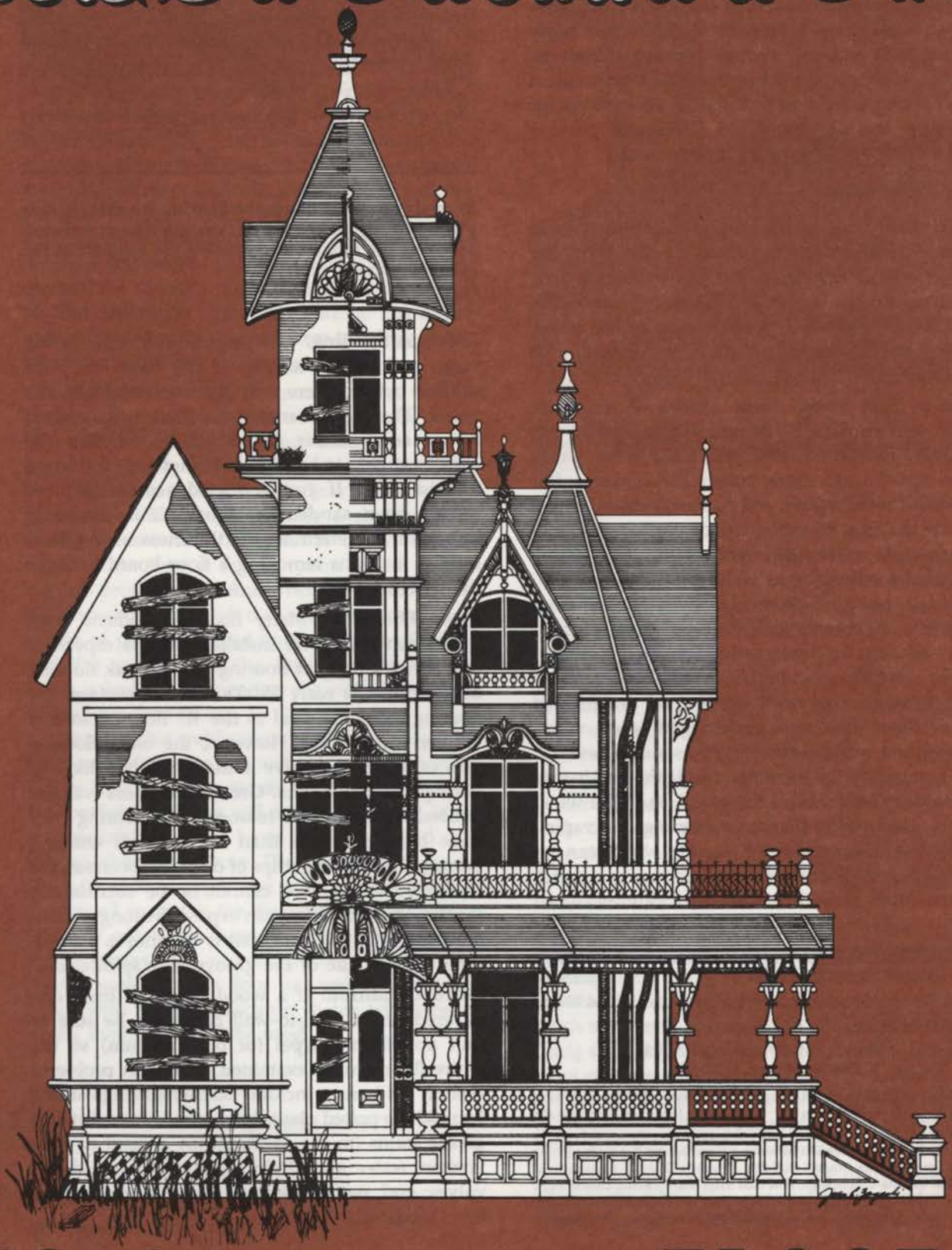
# OLD HOUSE RESTORATION



## NO. 3 FLOORS

New owners of old houses can find wood floors in good condition or in desperate need of a new finish. There are three ways to revive an old floor — recondition it, strip it, or sand it. A careful investigation of the floor should take place before a decision is made about which refinishing option to use.

Floors protected by rugs are good candidates for renewal. Floors where the wood itself is badly scarred will probably require sanding. However, sanding is not always the best solution for problem floors. This publication will discuss alternatives for renewing the beauty of old floors and provide information on finishes to protect them.

### Floor Condition

Examine the floor carefully before deciding to sand it. In evaluating the condition of the floor, the homeowner should determine: 1) whether the floor is a hard or soft wood; 2) whether the floor has been sanded before; 3) the thickness of the wood; 4) the condition of the wood; 5) the condition of the finish.

**Hard or Soft Wood.** Some species of wood are dense and durable. Oak and maple are in this category. The wood itself will resist wear. Other wood species are more vulnerable. These softer woods include fir, pine, and poplar. Although these five are the most common woods used for flooring, other wood species may have been locally available and used for flooring as well.

If it is not possible to identify the wood from its grain, the owner can find an inconspicuous spot and test for wear-resistance. Use medium-coarse sandpaper and sand a small spot. First, sand through the worn surface to undamaged wood. Then, sand the undamaged wood vigorously. If the wood seems easy to sand, if sawdust is generated by the sanding, and if the sandpaper leaves deep scratches in the wood, then the wood is soft. This means that floor sanding or scraping should be done carefully. A soft wood can be easily gouged. Therefore, large, commercial sanding machines should be used with caution.

**OLD HOUSE RESTORATION** **Number 3**



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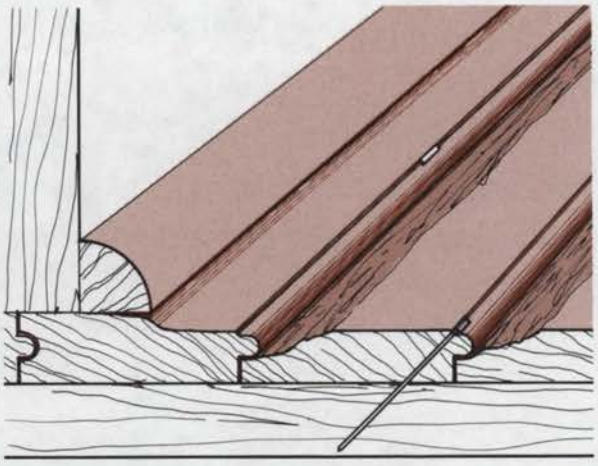


**Excessive sanding can make flooring too thin. In this picture the original floor thickness has been reduced, exposing the tongue, and causing the top part of the grooved piece to split off.**

**Previous Sanding.** Look around the edges of the room and in the corners. If the floor has been sanded before, there may be swirl marks in the wood. The swirl marks could have been caused by an edge sander. Check to see whether the corners appear to be slightly higher than the wood around them. If you find evidence of the floor having been sanded previously, it is extremely important to determine the thickness of the floor, even if it means removing a floor board to make the determination.

**Floor Thickness.** Many flooring products were thin when they were installed. This is especially true for oak-parquet flooring and for oak flooring installed in the early 1900's. On the surface, the flooring looks identical to the ¾" flooring sold in lumber yards today. However, the older flooring was often used to give a more finished look to wide-plank pine floors. Greater thickness was not needed for structural reasons. The flooring may have been no more than ⅜" thick. If either a parquet floor or thin strips of oak have been sanded in the past, the floor cannot be be successfully sanded again. Sanding can expose the tongue-and-groove joints. If a floor that is too thin is sanded, then the top side of the groove may splinter off.

**Wood Condition.** If a wood floor has been discovered under wall-to-wall carpeting, be sure to pull up all the carpet (or old linoleum) so the entire floor can be examined. Common problems seen in old houses include: blackened rings on the floor where potted plants have stood; animal stains; grease stains (in the kitchen); rot around or near kitchen water and drain pipes or near radiator valves; and, patches where furnace ductwork has been rerouted.

Before a floor can be refinished or sanded, problem areas must be identified and solutions found. For example, a careless floor patch where an old furnace register was located can be replaced with wood that matches the surrounding wood. Where animal or water rings are found, a wood bleach (available in kit form from a hardware or paint store) can be applied. Where rot has damaged existing wood, the rotted area can be replaced.

In addition to checking for these major signs of damage, the owner should look for signs of wear around entry doors and other traffic areas. In these areas or on stair treads, the wood itself may be worn and cupped. Sanding these cupped areas will be more difficult. It may not be possible to make them completely smoooth. However, it may not be desirable. Part of the charm of an old house is the patina of age. Evidence of previous generations having walked through its portals can be eliminated with overeager sanding. The homeowner may want to urge workers to take a gentle approach when reconditioning the floor.

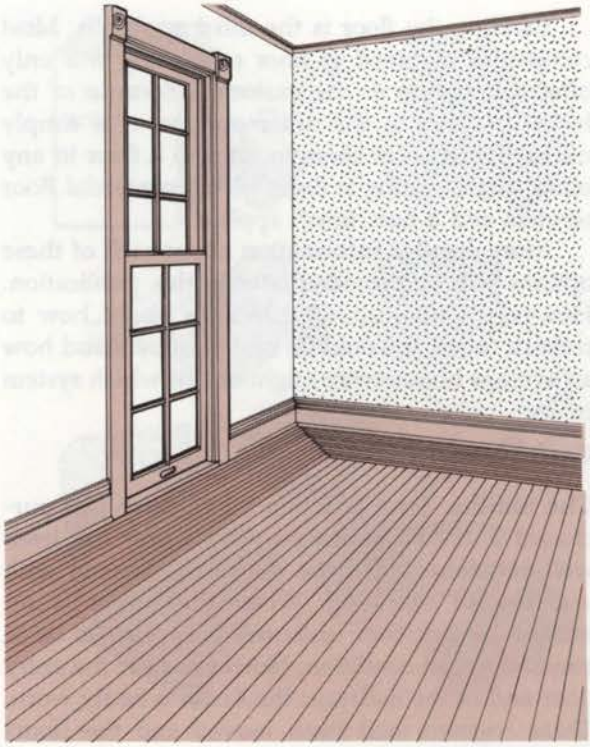
**Evaluating the Finish.** In many houses, there is no damage to the wood. When carpeting is pulled up, a floor in nearly perfect condition can be found. The only problem may be in the finish itself. Common problems include: a finish that has darkened with age (most likely a shellac or oil finish); areas where the finish is badly worn or scratched (in front of doors); rooms where an area rug has protected the finish beneath it but where the exposed fringe of the room has darkened; specks of paint spattered on the floor; and, grime and dirt ground into the finish. When just the finish is bad, the owner has the widest choice of refinishing alternatives.

Because this publication focuses on floor finishes and refinishing methods appropriate to older homes, refinishing methods appropriate to modern, prefinished floors will not be discussed. Modern prefinished floors have hot wax baked into the wood at the factory. The best way to renew these floors is to apply one or more coats of wax, prestained to match the flooring. Most blemishes will buff out. Since these floors use deeply penetrating stains and waxes, sanding them is not recommended. If the floor has serious problems, check with the manufacturer to see which refinishing method should be used.

## Refinishing Alternatives

Three kinds of refinishing can be done. The choices are to:

- Recondition the existing finish.
- Strip the existing finish.
- Sand the floor.



**Reviving the finish is the best choice for parquet floors or floors where decorative edging has been used.**

Reviving the existing finish is the strategy that best preserves the look and age of the house. Reviving an old shellac finish, for example, may be just what is needed to bring out the rich, golden color buried beneath the dirt.

The floor is first cleaned with a solvent-based, commercial floor cleaner or household cleaner. Light sanding may be needed. Then the floor is restored with a new finish. Reviving the finish is not necessarily the least work. It is a choice that would appeal to people with the time and energy to do the work themselves. It does not involve a great deal of skill, and it is virtually impossible to damage the floor. All that is required is old-fashioned elbow grease.

Removing the finish is a second option. Where water or animals have stained the wood, the existing finish will have to be removed. Also, where the wood itself is in poor condition, removing the finish may be an option. The finish can be removed using the solvent for the original finish, chemical paint stripper, or a metal paint scraper. Again, this is a labor-intensive process, and it may be difficult or impossible to find a floor refinishing professional who would be willing to refinish the floor in this way. This is an option where the homeowner can provide the labor. One room at a time can be done and the work spread out over a period of time.

Sanding the floor is the third approach. Most companies involved in floor refinishing will only offer this option to the customer. Because of the labor involved in the other options, it is simply not economical for them to refinish a floor in any other way. Sanding is done with commercial floor sanders and a new finish applied.

More detailed information about each of these options will be provided later in this publication. However, before giving directions about how to refinish floors, it would be best to understand how an average homeowner might decide which system to use.

### Case Studies

**The Smiths.** John and Sue Smith have just purchased a 1920's bungalow. The house has been well-maintained, but the floors are covered with wall-to-wall carpeting. When the carpet is removed, an oak floor underneath appears to be in generally good condition. However, near the entry door and in the hallways the finish is badly worn. Three registers had been moved and the floors patched with pine.

The Smiths hire a carpenter to patch the old register openings with oak. They sand the new oak flooring with a belt sander to bring it down to the same height as the existing flooring. Then they take a small sample of the existing flooring to the paint store for matching. The paint store tells them how to finish the new oak to match the old. They clean the entire floor and remove the wax, and then use varnish as the final finish.

**The Browns.** Another family, the Browns, move into a 1940's ranch house. There, the oak flooring has been damaged by a family pet. One room has been used to display the previous owners' collection of rubber plants, and the floor is water-stained. The Browns are busy lawyers and don't have time to do much work themselves. Besides, the house has no particular historical significance. They decide to hire a company to sand the floor down to bare wood and refinish it. If they had had time and confidence in their hands-on ability, they could have done the sanding themselves.

**The Carvers.** A couple from Savannah decide to buy an unoccupied brick farmhouse built in the 1830's. They devote their weekends to working on the house. By the time they have finished repairing the walls, putting in new wiring, and installing plumbing, their budget is running low. It doesn't look like there will be enough money to buy the hardwood flooring they had dreamed about. Besides, they have grown fond of the old, 14-inch-wide pine flooring. They enjoy the worn marks in the hall where the old coat tree and boot rack had stood. They decide to thoroughly clean the floors, vacuum them, and apply an oil finish and wax. They protect the high-traffic areas with carpet runners and area rugs.

These examples illustrate how important it is for owners to be aware of the broad range of refinishing alternatives. For historic houses, the owners should consider finishes which were originally used and find out how floors were maintained. Many old-time finishing techniques are still serviceable today.

## REVIVING FLOORS

If the floor is not too badly scarred, renewing the old finish (with varnish, oil, or shellac) may be enough. Work on a test patch to see whether the floor can be revived. Wash the old finish with mineral spirits and fine steel wool to remove dirt and wax. A commercial wood floor cleaner, available in most grocery stores, is another option. If dirt appears to be deeply embedded, warm water and a heavy duty detergent can be used, along with a scrub brush. However, the water will remove some of the finish, and it can damage the surface if it is left on the wood. Use old towels to mop up the water immediately. Only work on a small section at a time.

Once the floor is clean, try to determine the old finish. A very common old finish was pure shellac, or shellac covered with varnish. If the finish was shellac, it can be revived with denatured alcohol and steel wool. If the finish was a shellac-covered varnish, a homemade finish reviver made of ⅓ turpentine, ⅓ linseed oil, and ⅓ vinegar (with denatured alcohol added as needed) works well.

**Heavy rubber welder's gloves should be used when reviving or refinishing floors. Steel wool is used to apply a finish reviver. The reviver slightly liquifies the finish, allowing the worker to wipe off the old darkened finish with the steel wool pad.**

Where a 1- or 2-foot discolored band stretches around the edge of the room, the darkened area should be thoroughly cleaned. Dirt and exposure to sunlight have discolored this strip. If cleaning does not lighten the strip, it may be necessary to remove the finish from the entire floor.

When only parts of the floor are in bad shape, these spots can be sanded and new finish matched to the old. Color can be matched if test strips are made. A test strip is a piece of wood identical to that used on the floor. Different combinations of stain and finish are created on the strip of wood. A record is kept of each trial section. When the finishes dry, the strip can be compared to the original finish and the matching finish can be selected.

The newly finished area is "feathered" into the original finish and rubbed down lightly with extra-fine steel wool when dry. The steel wool removes the sheen of the new finish, making its reflectance closer to that of the old finish.

## REMOVING THE FINISH

Often, an old finish can be removed using the original solvent of the material. Shellac, for example, is easily removed with denatured alcohol. The solvent is applied to a 2-square-foot-area, and the area is scrubbed vigorously with medium to medium-fine steel wool. The residue is removed with a putty knife and the floor wiped with rags.

If the floor boards are smooth and even, an old finish can be removed with a wide-blade paint scraper. Pressure is applied to the scraper and the blade is pulled toward the operator. The blade must be sharpened periodically with a file or on a sharpening stone. This method of removal is less messy, and it does not involve breathing solvent vapor.

When working with paint stripper, the third removal method, it is extremely important to use an OSHA-approved respirator. The respirator should have cartridges that can be changed, depending on which vapor is being breathed. The cartridges prevent toxic chemicals from reaching the worker's lungs. In addition, the room should be well-ventilated. Make sure the chemicals used in the paint remover selected will be removed by the cartridges in the mask.

A natural-bristle paint brush with a wood handle must be used to apply the paint stripper. An inexpensive, polyester-bristle brush will dissolve. Also, good gloves are a necessity. Gloves worn by welders will prevent the stripper from burning the hands. These gloves can be purchased at welder's supply stores.

Apply the stripper with the paint brush by


**These are the tools needed for removing the old finish on a floor: professional-grade paint stripper; a natural-bristle brush; welder's gloves; a metal scraper; medium-grade steel wool; a bucket; rags or old towels; three grades of sandpaper; a respirator; a 4-inch orbital sander; a sanding block (made from a 2×4 wrapped with sandpaper).**

**After using the finish reviver, a new finish can be applied. If just one area on the floor has been treated, the new finish can be gently brushed (or "feathered") into the adjacent finish.**

**Scraping off old finish near radiators must be done by hand. The hand scraper and sanding block are needed for inaccessible areas.**

flowing it on in one direction only, working on a 3-foot-square area at a time. Allow the stripper to work for five to seven minutes. If it has not loosened all the finish, apply a second coat and let it work for two to five more minutes. Then use a putty knife the scrape up the residue. A metal pan or can should be used to hold the residue. Depending on the thickness of the finish, a final coating of stripper may be necessary. The final coat should be removed with medium steel wool.

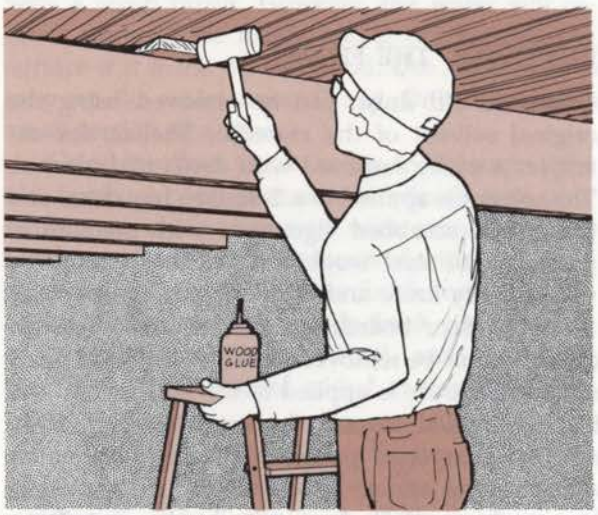
After the old finish is removed, the paint stripper must also be removed because many commercial strippers contain paraffin. A paraffin residue will interfere with the new finish. After the floor has been completely stripped, the following items should be brought to the work area: a plastic bucket of very hot water; heavy-duty liquid household cleaner (but not one containing ammonia); a brass-bristle brush (available in housewares departments); and rags.

Pour ½ cup of the cleaner into two gallons of water. Dip the brass-bristle brush in the hot liquid and use it to scrub the paint stripper off the floor. Apply the water sparingly. Wipe the water off with rags as soon as a small section of the floor has been scrubbed. Do not allow the water to sit on the floor, or it will warp the floor boards. It is very important to keep the water hot and the mixture in the bucket clean. When the water begins to cool down or get dirty, empty the bucket and start with a fresh rinse solution. For a 15 × 15-foot room, stripping the finish and rinsing the stripper will take about two days of hard work.

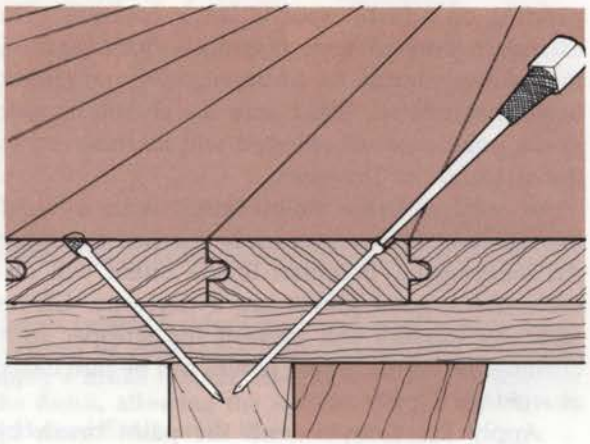
After the finish has been removed, the floor will be as clean and new-looking as if it had been sanded. At this stage, any stains in the floor can be bleached, following the directions on the wood-bleach package. Wood-bleach may raise the grain of the wood. Wait until the bleached area is thoroughly dry and sand with an orbital sander. It may also be desirable to sand the entire floor. Sanding with a hand-held orbital sander should not cause problems for thin flooring.

## REPAIR DAMAGED AREAS

Take time to repair any damaged areas before refinishing the floor. Secure loose, squeaking floor boards. If the floor is above an unfinished basement or crawl space where joists are exposed, check beneath for gaps between joists and subflooring. Drive glue-soaked wedges from below into the gap to silence the squeak. If the floor is not accessible from below, the floor boards will have to be nailed from above.




**Where floors are accessible from below, triangular shims can be covered with glue and driven in place with a mallet. Otherwise, the floor boards must be nailed from above. Use a nail set and putty to hide the holes.**



Using 10d finish nails, toenail the boards (nailing in opposite directions at about a 45-degree angle to form a V) through the subfloor and into a joist below. Begin at the center of the squeaking area and space each pair of nails outward every 6 inches until the floor is secure. If the finish flooring is the only part that is squeaking, 6d finish nails can be used to secure the finish flooring to the subfloor. Countersink the nail heads and fill the holes with a product that will accept a stain (if the floor is to be stained). Any split or damaged floor boards should be replaced.

**Removing Adhesive-attached Flooring.** Linoleum, asphalt tile, indoor-outdoor carpeting, and sheet vinyl are often found in kitchens, baths, and other rooms, glued to perfectly good wood flooring. It is possible to remove adhesive-attached flooring, but removal can be difficult. In many cases, there is more than one additional surface. Old houses often have three or four layers of sheet flooring.

Old linoleum was almost always applied with a water-soluble adhesive. The adhesive was spread over the floor, a layer of waterproof building paper was applied to it, more glue was applied, and then the linoleum was installed. After using a pry bar to pull up the linoleum, the building paper must be removed. Very hot water can be used to dissolve the glue, but the water will not penetrate the building paper. Working in small sections at a time, score the building paper with a utility knife (being careful not to score the wood) and apply hot water. The water will penetrate the scored areas and dissolve the adhesive. A stiff putty knife can be used to remove the paper. The adhesive is slow to dissolve, but hot water will dissolve it.

More recently, flooring surfaces have been applied with solvent-based adhesives. In most cases, it is possible to pull up the flooring with pry bars. However, the adhesive should also be removed before sanding, if at all possible. Hardware stores carry products to remove flooring adhesive. Alternately, xylol (or xylene) can be used. This solvent is very potent. Always make sure doors and windows are open, and use a fan to blow the vapor outdoors. An OSHA-approved respirator with cartridges to remove organic solvent vapor is a necessity.

To avoid the use of strong solvents, one can use a power sander. The presence of adhesive means that the paper on the sander will clog more easily. Contrary to the normal practice of sanding with the grain of the wood (described in the next section), where there is a heavy residue of adhesive on the floor, the first pass across the floor should be at a 45° angle to the grain. This will remove the high spots. Sanding can then proceed.

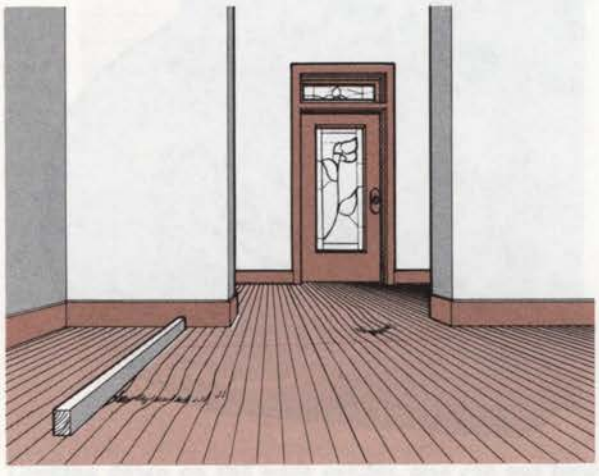
## SANDING THE FLOOR

Homeowners with good construction skills can successfully sand floors themselves. For those who are just beginning to learn "hands-on" skills, floor sanding can be a discouraging experience. This is because an inexperienced operator can damage a floor by creating undulations that are very apparent the moment the new finish is applied.

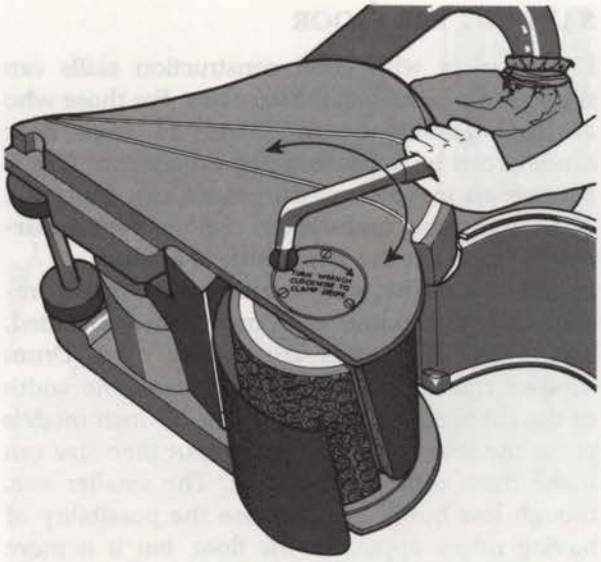
For those who wish to attempt this job themselves, floor sanding equipment can be rented. Two kinds of sanders are usually used. Drum sanders come in 8- and 12-inch sizes (the width of the rubber sanding drum). The 12-inch models cover the area with less motion, but their size can make them difficult to handle. The smaller size, though less bulky, can increase the possibility of having ridges appear in the floor, but it is more maneuverable in small rooms. The drum sander is meant for sanding the largest floor area in the room.

Because most drum sanders cannot get closer than 3 to 4 inches from the baseboard, a second sander is needed. This is usually a large, orbital sander — operated while on hands and knees. Its orbital action is, at best, a compromise between sanding with the grain and sanding across the grain, as would occur if a belt sander were used to edge-sand the floor. Both sanders should be equipped with an attached vacuum dust collector.

Other tools needed are: a sharp hand scraper with a long handle (for maximum leverage); an OSHA-approved mask for particulate removal and clean filters for it; and a small orbital sander. The small orbital sander is used for removing any swirl marks left by the large orbital sander and for reaching further into the corners.

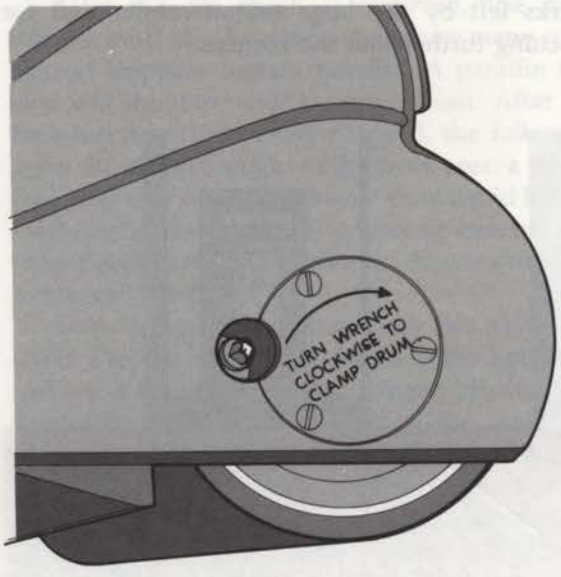


**This picture shows what can happen if the sander is allowed to remain in one place too long. The undulations that result will not add to the beauty of the floor.**

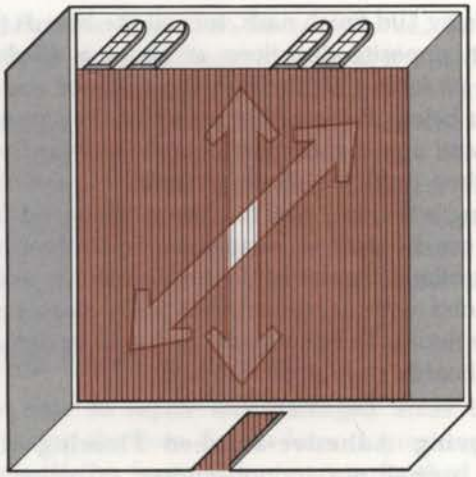


**Have the tool-rental salesperson demonstrate how to change the sandpaper on a drum sander.**

Three grades of sandpaper are needed for hardwood floors — two if the floor is soft wood. Coarse, open-coat (#2) is for very rough sanding. It would be appropriate for painted hardwood floors. Medium grit (#½) is used for the first sanding of floors with clear finishes or for soft wood floors. The finish grade (#0) is for final sanding. When the sander is rented, ask the equipment dealer to demonstrate how the sanding belts should be installed.



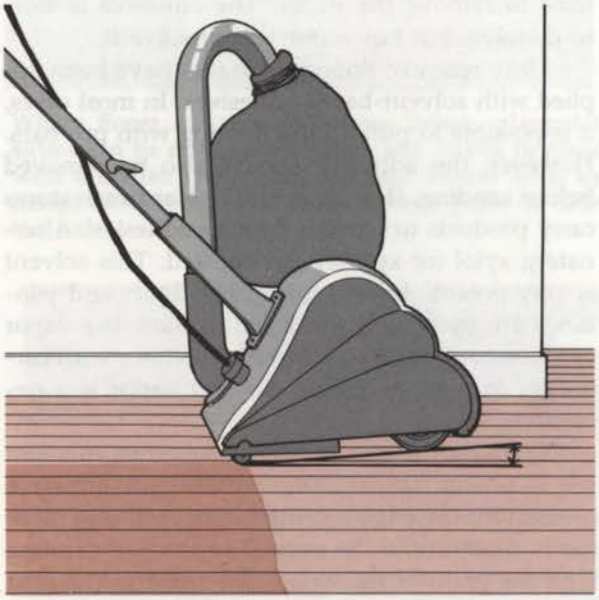

**The sandpaper must be tight on the drum. Be sure all adjustments are completed before beginning to use the sander.**



**Always sand with the grain of the wood. Sanding perpendicular to the grain may leave permanent sanding scars.**

Also, be sure the house can handle the electrical requirements of the sander. Commercial sanders should only be operated from a 20-ampere circuit, wired with #12 wire. Plugging the sander into a 15-ampere circuit runs the danger of blowing a fuse.

Before beginning, remove the shoe mold, or base shoe. This is the small strip of wood installed at the intersection of the baseboard and the flooring.



**Notice the little arrow at the front of the sander. This shows that the front of the sander is lifted up off the floor. The back wheel of the sander is actually a pivot wheel.**

**Getting the feel of the sander is an important part of sanding. Practice first on a piece of plywood. Then sand the main body of the floor following the instructions on this page.**

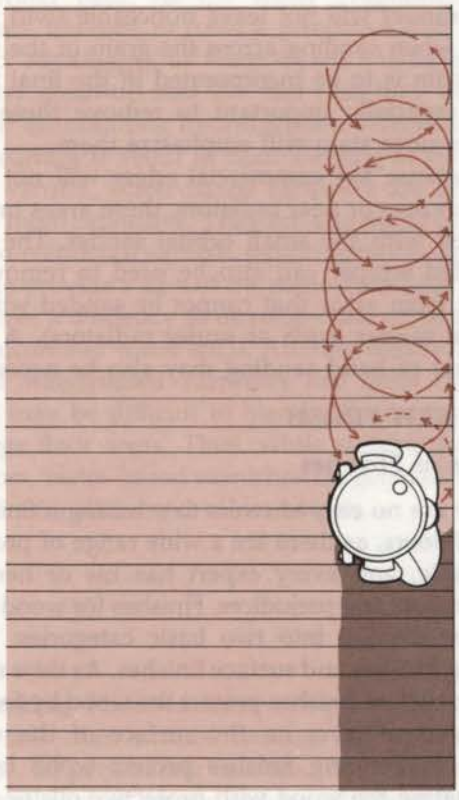
All sanding should be done with the grain of the wood. Begin in one corner of the room. Turn the machine on only when the sanding drum is tilted up. When the sander has been turned on, the operator gradually lowers the sanding drum and begins to walk backwards toward the opposite corner of the room. As the operator backs up to the wall, he or she gradually raises the drum and stops. **Never allow the machine to stop moving while the drum is in contact with the floor.**

The next pass at the floor must overlap the first slightly. The procedure is exactly like mowing a lawn, only the operator is "pulling" the machine. Never push a power sander.

The next step is fine sanding. Vacuum the floor after using medium-grit sandpaper; then, get down on hands and knees and shine a flashlight across the floor and look for any high or low spots. A small orbital sander can be used to smooth these imperfections.

When the fine sanding is done, the edges of the room must be sanded. Use the edger and the same sequence of papers (rough, medium, and fine, or just medium and fine). To remove the circular marks left by the commercial edger, use a medium grit paper and the small orbital sander.

**The large edge sander must be operated while on hands and knees. It operates with a circular motion, making it possible to ignore the direction of the grain when sanding.**



**Looking down on the edge sander, one can see how close the sander can come to the walls. Always remove the base shoe before sanding. Then, when the base shoe is reinstalled, it will cover the narrow strip that the sander could not reach.**

**The small orbital sander is used to remove any swirl marks left by the edge sander and to sand in corners.**

This sander will not leave noticeable swirl marks even when sanding across the grain of the wood. If a stain is to be incorporated in the final finish, it is especially important to remove these swirl marks since stain will emphasize them.

Because the commercial edger will not reach into corners or near radiators, these areas must be sanded with the small orbital sander. The long-handled scraper can also be used to remove old finish from areas that cannot be sanded with the orbital sander (such as under radiators). A small amount of hand sanding may also be necessary.

## THE NEW FINISH

### Types of Finishes

There are no easy answers to selecting a finish for wood floors, as there are a wide range of products available, and every expert has his or her own preferences and prejudices. Finishes for wood floors can be divided into two basic categories: penetrating finishes and surface finishes. As their names imply, surface finishes protect the wood by forming a protective layer on the surface of the wood, while penetrating finishes protect wood by impregnating the wood with protective oils or resins which harden in the pores of the wood, making the surface more resistant to scratches, nicks, and stains. Being the more reversible of the two, surface finishes are commonly chosen for homes where future owners may wish to change the finished appearance of the floor.

**Surface Finishes.** Surface finishes can be further categorized as quick-drying ("spirit varnish") and slow-drying varnish. Included in the spirit varnish category are shellac, quick-drying varnish, and lacquer. Lacquer is almost never used on floors because it dries too rapidly to apply over a large area.

Spirit varnishes form their films by the evaporation of the solvent. When recoating or applying subsequent coats of spirit varnish, the solvent in the new coat attacks the previous coat, and a bond is formed by the partial dissolving of the previous coat. This makes spirit varnishes the easiest of the surface finishes to touch up or repair. Since the solvents in spirit varnishes evaporate rapidly, drying time is short. Less time is required to finish the job, and dust in the room presents little problem for the finished surface. On the other hand, both shellac and quick-drying varnish are extremely brittle, and neither provides a durable, long-wearing surface. The main reason that shellac was used on floors in old houses is that it was readily available. For historical accuracy, shellac would be an appropriate finish, but other finishes provide better serviceability. If shellac is chosen, it is best to use it in bedrooms or other low-traffic areas. Make sure the wood is a hardwood (typically oak or maple), and use it only in areas where it will not be subject to spills of water or alcohol (both will leave a white stain on shellac). Plan to wax the floor regularly.

**Slow-Drying Varnish.** The slow-drying varnishes — oil varnish, synthetic alkyd resin varnish, and polyurethane — provide a far more durable surface than spirit varnishes. In contrast to the evaporative curing of spirit varnishes, slow-drying varnishes cure by polymerization, which forms a chemical bond between the finish and the wood.

When applying several coats consecutively, bonding between coats is not a problem. If too much time has elapsed, usually more than 24 hours, the previous coat must be sanded with a fine sandpaper (120-grit) to provide a roughened surface to which the new coat can adhere. With conventional varnishes, this roughing up, along with thorough removal of any dirt build-up, should ensure good adhesion of the new coat.

When using either conventional varnish or polyurethane, all dust must be thoroughly vacuumed from tops of windows, curtains, and walls, as well as from the floor. The relatively long drying time required by these finishes means that any dust in the room is liable to settle in the wet surface of newly applied varnish or polyurethane and mar the finished surface. Allow sufficient time for dust to settle after vacuuming; then use a tack rag to remove dust particles from the floor.

Where the similarities between conventional varnish and polyurethane end, the controversy begins. Polyurethane has been promoted as the wonder product for floor finishing, and it does have some desirable characteristics. Proper application of a three- or four-coat polyurethane finish will provide a hard, durable finish for wood floors. It is self-leveling, making application of a smooth coat of uniform thickness easy. It is particularly suitable for kitchen areas because the surface can be damp-mopped; and, it will not develop white stains from spills of water or alcohol. Polyurethane is also highly resistant to scars and gouges from sliding chairs across its surface.

The main drawback of a polyurethane finish is the uncertainty of establishing a good bond between the polyurethane and a previously finished floor. As a general rule, polyurethanes are not compatible with sanding sealer, lacquer, shellac, high-stearate stains, and paste wood fillers. They also cannot be applied over any previous surfaces such as penetrating oils, varnish, or wax. For a new floor, compatibility poses little problem, but with previously finished floors, it is difficult to insure that all traces of the old finish have been removed. Oak floors typically have had a paste filler applied to them, and the only way to remove this filler is by completely sanding the floor. If the floor has been stained previously , it must also be sanded to bare wood, unless it can be proven that the stain is one that is compatible with polyurethane. When using polyurethane, it is a good idea to purchase a system of products where sealer, stain, filler, and polyurethane are all produced by the same manufacturer and are designed to be compatible with each other.

An alternative to polyurethane, oil varnish has a softer, more flexible surface, and for this reason is more suitable for use on softwoods such as pine. Very old pine, however, may turn red if varnished. It should be sealed first with a thin coat of either shellac, lacquer, or sealer. High-gloss alkyd varnish produces a finish which is harder than polyurethane. Since oil and alkyd varnishes are compatible with most stains, fillers, and previous finishes (except polyurethane and wax), varnish is a good choice for a floor finish.

Previous applications of wax will present problems when applying varnish to an old finished floor. While chemical strippers are available to remove wax, it is not advisable to rely on them to completely remove all traces of wax. If it is possible that the floor has been waxed, and the floor is thick enough to tolerate sanding, it is best to sand the floor before applying fresh varnish.

Because of the problems wax creates, it is questionable whether a varnished floor should be waxed. Conventional wisdom says that regular waxing will prolong the life of the finish. However, the wax must be properly maintained. As long as there is a wax film on top of the varnish, the varnish will never wear through. However, if no wax is used, it is possible to recoat the floor with varnish without sanding or stripping the floor to bare wood. Light hand sanding of the floor will provide "tooth" for the new coat; then the floor can be revarnished.

High-gloss varnish gives a more durable, longer wearing surface than semi-gloss or satin finish varnish. This is because one coat of gloss yields a film which is approximately ¾ mil thick, while one coat of satin is about ½ mil. Also, when gloss varnish dries, it forms a harder surface. If the appearance of a satin finish is preferred, the best solution is to apply two or three coats of gloss varnish as a base, then finish with one coat of satin varnish. A properly applied finish of three coats of varnish should last five years in high-traffic areas and much longer in low-traffic areas.

Another type of varnish suitable for floors is water-based varnish. Water-based varnish consists of film-forming polymers, usually acrylic resins, in a water base. As the water evaporates, the polymers coalesce to form a protective film. Two distinct advantages of water-based varnishes are the easy clean-up and the fact that they do not give off air-polluting hydrocarbons. While the finished surface is about as hard-wearing as conventional varnish, water-based varnishes are considerably more expensive. They are also much thinner than conventional varnish, requiring twice as many coats to provide a film of the same thickness. They also have a tendency to develop dull, white stains from alcohol or water spills. Another disadvantage is that water-based varnishes dry quite rapidly, and it may be difficult to blend adjacent sections on large floor areas. Thus, while suitable for use on floors, water-based varnishes are generally used only for furniture and cabinet work.

**Penetrating Finishes.** Less reversible, but more renewable than surface finishes, are penetrating finishes. In penetrating finishes, the "vehicle" is a drying oil such as linseed or tung oil. Many finishes also use resins. To produce a resin finish, penetrating oils are chemically changed (in the factory) in order to improve drying time and predictability. If moisture resistance is important, a product with a tung oil or Danish oil base will provide better service than a product with a linseed oil base.

Penetrating Finishes

Surface Finishes — more reversible

| | | Method of Curing | Solvent | Removal |
|---|---|---|---|---|
| "Spirit Varnishes" | Lacquer | Evaporation of solvent | Lacquer thinner | Application of solvent |
| | Shellac | | Denatured alcohol | |
| | Quick Dry Varnish (gloss) | | Mineral spirits | |
| Slow Drying Finishes | Oil-based, alkyd-resin varnish<br>Gloss or satin | Cures by polymerization | Paint thinner or mineral spirits | Commercial stripper (methylene chloride) |
| | Polyurethane<br>Gloss or satin | Cures by polymerization | Paint thinner or mineral spirits | Commercial stripper (methylene chloride) |
| | Water-based varnish<br>Gloss or satin | Coalescing of film-forming polymers as vehicle (water) evaporates | Water | Commercial stripper (methylene chloride) |

| | | Misc. | Pros |
|---|---|---|---|
| Drying Oils | Tung oil<br>Linseed oil | Linseed oil not as resistant to moisture as tung oil | • easy to apply — no special tools required<br>• low odor<br>• room dust not a problem<br>• easy to repair minor surface injuries<br>• rich patina — not too glossy, not too dull |
| Resin Finishes | Resin oils | | • improved drying & predictability |

| Compatibility | Pros | Cons |
|---|---|---|
| • As sealer before applying oil-based varnish<br>• Not compatible with oil stains<br>• Cannot apply over old wax | • Don't need to sand to recoat<br>• Orange shellac may be applied over new wood to give "antique" appearance<br>• Rapid drying decreases total refinishing time and reduces dust | • Too brittle for soft wood<br>• Low durability<br>• Becomes stained from spills of water or alcohol<br>• Lacquer dries too fast to be used on a floor |
| • Compatible with most stains & fillers<br>• Cannot apply over old wax | • Can be used over old finish of Tung oil<br>• Can be used over sealers of shellac or lacquer<br>• Durable finish<br>• Gloss, alkyd varnish dries harder than polyurethane | • Slow drying. Requires that room be thoroughly vacuumed & dusted before application<br>• Not self-leveling<br>• Sand to recoat |
| Not compatible with:<br>• Paste fillers<br>• High stearate stains<br>• Shellac<br>• Lacquer<br>• Sanding sealer<br>Compatible with:<br>• Oil-based stains<br>• Water-based stains | • Long-lasting, durable finish<br>• Requires little maintenance<br>• Self-leveling | • Old finish must be completely removed (usually by sanding) to eliminate bonding failure.<br>• Must sand to recoat<br>• Need to remove dust from room because of slow drying |
| Compatible with most stains | • No hydrocarbon pollution<br>• Easy clean-up<br>• Dries faster than conventional varnish<br>• About the same durability as conventional varnish | • More expensive than conventional varnish<br>• Requires twice the number of coats for same film thickness as conventional varnish<br>• Stains from water or alcohol spills |

| Cons | Compatability |
|---|---|
| • Not long-wearing — must be reapplied regularly<br>• Oil darkens with age<br>• Oils are highly inflammable. Dispose of oil-soaked rags carefully to avoid spontaneous combustion.<br>• Requires waxing for abrasion resistance | • Tung oil not compatible with paste wax<br>• Linseed oil not compatible with lacquer<br>• Tung may be used as sealer for oil varnish |

There are many advantages to a penetrating finish. There is little odor, they are easy to apply, and they require no special tools. Since the finish dries inside the pores of the wood, not on the surface, dust in the room is not as much of a problem with penetrating finishes as it is with varnish. Small nicks, scratches, and burns can be easily repaired by lightly sanding or rubbing the affected area with fine steel wool, then rubbing in a small amount of oil until the patch matches the sheen of the surrounding area.

Several applications of penetrating oil or resin produce a deep, rich patina which cannot be duplicated with any other finish. Penetrating oils, however, require a rather long time to dry. (Resin finishes dry more quickly.) This drying time, coupled with the need for several applications, may cause some inconvenience for the homeowner.

Oils also tend to darken with age, changing the color of the floor. While some floor refinishers consider this darkening a disadvantage, others believe it adds to the patina and character of the floor. Since the penetrating finish does not leave a protective film on the surface, regular waxing is recommended.

One important thing to remember when applying a penetrating finish is that the oils and resins are highly inflammable. If oil-soaked rags from applying these finishes are wadded up together, the heat generated by the drying of the oil can cause spontaneous combustion. Either spread out the rags to dry in a place with plenty of air circulation, or burn them immediately.

## APPLYING THE FINISH

Once all traces of the previous finish have been removed and the floor has been thoroughly cleaned, the new finish should be applied as soon as possible to keep dust and dirt from being ground into the bare wood. If the floor is oak, a paste filler may be desirable. Oak has a porous, open grain, and it is customary to apply a paste filler before staining and finishing. If filled, the finished surface of an oak floor can be as smooth as a maple floor, but it is not mandatory to use a filler. Without a filler, the finished surface will not be as smooth, but the floor will still be protected from stains and abrasions.

The next step after filling is staining. Staining is also optional, but stain can be used to disguise dark stains in the wood or to enhance the grain. Remember, the darker a floor is, the more it will show dust and scratches, so think twice before choosing a dark stain. Stain and paste filler can be mixed together (two parts filler to one part stain) to give an exceptionally smooth finish to an oak floor.

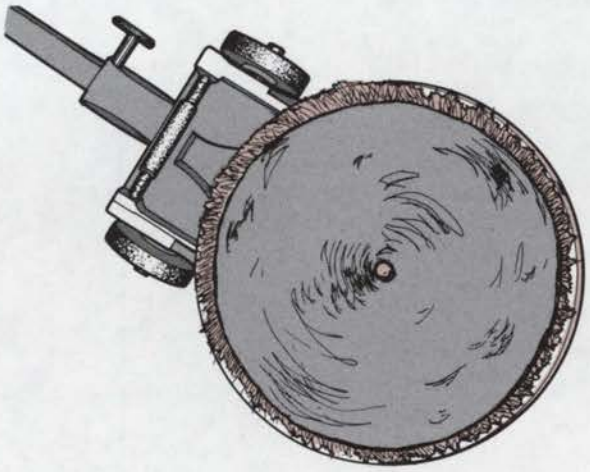
**Many finishes can be applied with a foam paint roller. This method of applying the finish is less tiring than brushing it on.**

When filler and stain have been applied, the owner can apply the finish. Some manufacturers recommend the use of a sanding sealer prior to applying the finish. A sanding sealer merely provides a less expensive first coat. The sealer also takes less time to dry. It is perfectly acceptable to bypass sanding sealer and apply the varnish or polyurethane to bare or stained wood. If the floor is very old pine, however, the floor should be sealed with shellac or sanding sealer before applying varnish, as oil varnish may cause old pine to turn red.

After application of the first coat (whether it is sanding sealer or the first finish coat) check the floor for raised or fuzzy grain. If the grain has been raised, lightly sand the floor by hand with a 120 grit paper to remove the raised grain, then apply one or two more coats of finish.

### Finishing Touches

Before applying the final coat of varnish or polyurethane, it is a good idea to buff the floor to smooth out any air bubbles, dust bumps, or brush hairs. This is done with a commercial floor machine and steel wool pads. The floor machine can be rented at a rental agency, and the agency will supply the steel wool pads.



**A steel wool pad is placed on the bristles of a commercial floor buffer.**

To use the steel wool pads, attach a stiff, bristle brush supplied with the machine to the bottom of the machine. Lay the round steel wool pad on top of the brush and press the steel wool onto the bristles. Turn the machine right-side-up and place it in the middle of the room, as far as possible from any walls and doors. It takes practice to be able to control the machine. The first few attempts to start up the buffer might result in the machine jerking out of control. With practice, the machine is easier to maneuver.

After buffing the floor, the refinisher must remove the residue of small steel fibers before applying the final coat of finish. First, give the room a thorough vacuuming with a shop-vac, then wrap cheese cloth or an old towel which has been soaked in mineral spirits around the head of an old sponge mop, and mop the room, stopping frequently to change the cheesecloth. Remember, the mineral-spirits-soaked rags are highly inflammable, so be sure to let them dry with plenty of air circulation, or burn them to avoid the possibility of spontaneous combustion.

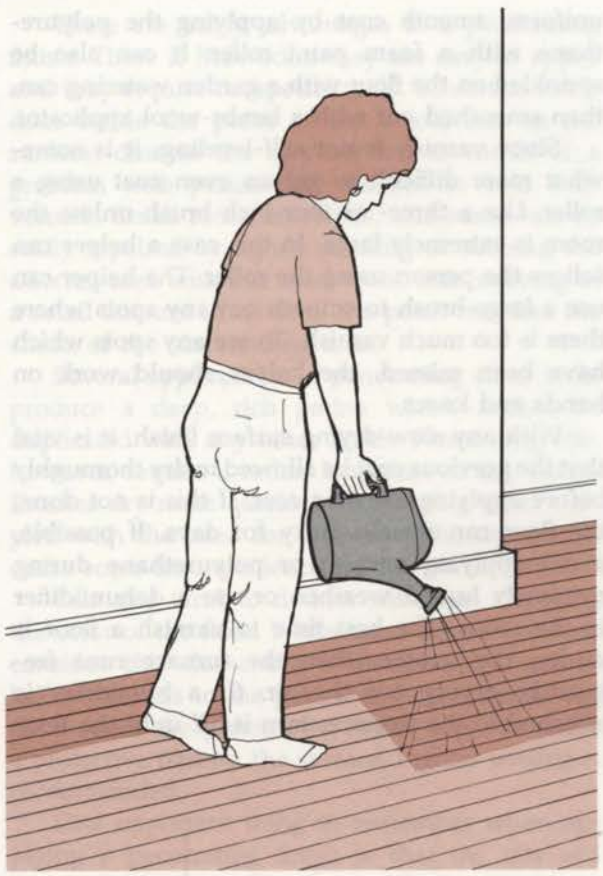
If buffing with a commercial machine sounds intimidating, it is. But the worst part is cleaning up the steel wool fibers. This method is efficient if there is a large room or an entire floor of a house to refinish. In a smaller room, sanding the floor by hand with wet-or-dry sandpaper will smooth out any blemishes just as effectively as buffing, and with less mess. As with buffing, wipe the floor thoroughly with mineral spirits before proceeding with the final coat.

The decision of whether to use a brush or a roller to apply varnish or polyurethane will depend, to a great extent, on the size of the room and the personal preference of the finisher. As polyurethanes are self-leveling, it is easy to get a uniform, smooth coat by applying the polyurethane with a foam paint roller. It can also be sprinkled on the floor with a garden watering can, then smoothed out with a lambs-wool applicator.

Since varnish is not self-leveling, it is somewhat more difficult to get an even coat using a roller. Use a three- or four-inch brush unless the room is extremely large. In this case a helper can follow the person using the roller. The helper can use a large brush to smooth out any spots where there is too much varnish. To see any spots which have been missed, the helper should work on hands and knees.

With any slow-drying surface finish, it is vital that the previous coat be allowed to dry thoroughly before applying the next coat. If this is not done, the floor can remain tacky for days. If possible, avoid applying varnish or polyurethane during extremely humid weather, or use a dehumidifier in the room. The best time to varnish a floor is during the winter when the furnace runs frequently, drying out the air. (If a humidifier is attached to the furnace, turn it off until the floor

**Begin buffing in the middle of the room. Commercial equipment like this is heavy. Operating it requires a good sense of balance.**



**A polyurethane finish can be applied by sprinkling it from a garden sprinkler.**

**Spread the polyurethane with a lambs wool applicator.**

is dry.) Allow the floor to dry thoroughly before moving furniture back into the room. Usually forty-eight hours will be sufficient. With reasonable care, a freshly finished floor should stand up to many years of wear.

**Maintenance.** Wood floors can be maintained by light dust-mopping. An aerosol furniture cleaner can be sprayed on the dust mop, as long as the cleaner does not contain wax. Furniture polishes which contain wax will make the floor too slippery to walk on.

If dust-mopping does not clean the floor adequately, the floor may be damp-mopped with a mild cleaning solution. Vegetable-oil-based soaps are suitable for use on woodwork. Excess water can fill the cracks between boards and cause the wood to swell. Be sure the mop is as dry as possible and that any excess water is wiped up quickly.

When more than washing is required, or the finish has become nicked or gouged, recoating the finish is relatively easy. To recoat a spirit varnish, thoroughly clean the floor (removing any trace of dirt, wax, or oil) then apply an additional coat of the same finish. Since the solvents in slow-drying varnishes are not able to partially dissolve the previous coat and form a chemical bond, they require more preparation than spirit varnishes. After all dust and dirt have been removed, the floor should be lightly sanded with fine sandpaper or buffed with a steel wool pad to rough up the surface and provide "tooth" for the new coat. The floor should then be thoroughly wiped with a tack rag before recoating.

If only a small area of the room is worn, it is possible to buff and recoat only the affected area, recoating one or two times to build up a sufficiently thick protective surface. The final coat may be thinned with the appropriate solvent and blended into the finish on adjacent flooring. If the newly applied finish is too glossy, it can be lightly abraded with 240- or 320-grit sandpaper.

For a floor with a worn penetrating finish, minor blemishes can be repaired by lightly sanding the area or rubbing the spot with fine steel wool. A small amount of the penetrating finish can then be rubbed into the affected area.